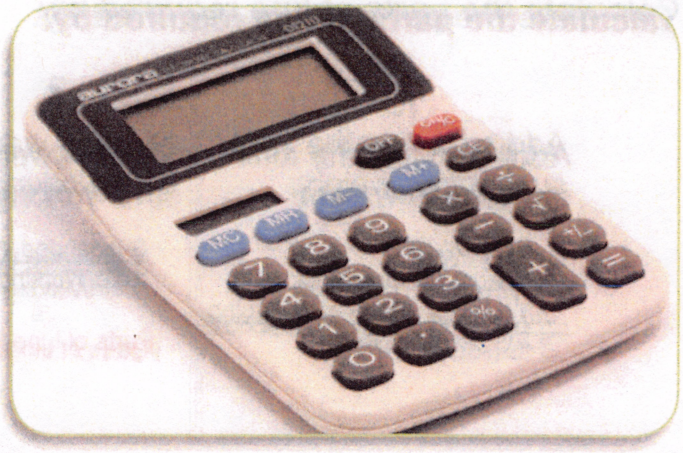
Module 22
Calculating Crane Capacity & Parts of Line



Learning Objectives

By the end of this section, you will:

1. Know how to count parts of line.
2. Know how to calculate the required parts of line.
3. Know how to calculate gross capacity, net capacity, approximate boom tip height, boom angle, maximum radius and excess reeving by utilizing load chart information.

Calculating Parts of Line

The operator must ensure that the crane is rigged with enough "parts of line" to not exceed Safe Working Load of the wire rope.

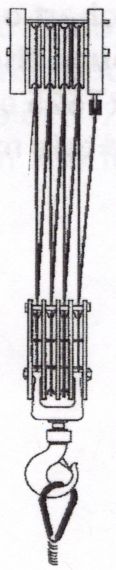
The operator must ensure that before any lift is made the crane has sufficient net capacity to lift the load.

Calculating parts of line may be necessary to determine the size and weight of the hook block to be used.

When determining capacities, line pull and safe working load of the wire rope must be taken into consideration.

Permissible line pull is the maximum allowable line pull based on the strength of the winch.

Parts of line are counted by counting the number of lines of wire rope above the hook.



8 parts of line

Calculate the parts of line required by:

1.

Adding to find the total suspended weight:

Load Weight
+ Weight of Hook Block
+ Weight of Slings and Rigging
= Suspended Weight

2.

Dividing weight by safe working load OR permissible line pull (whichever is lower)

Suspended Weight
Safe Working Load
=
Parts of Line Required

Some crane manuals state the maximum loads for reeved load blocks, depending on the parts of line.

WIRE ROPE CAPACITY

Maximum Lifting Capacities Based On Wire Rope Strength			
Parts of Line	3/4" Type RB	3/4" Type ZB	Notes
1	12,920*	15,600	Capacities shown are in pounds and working loads must not exceed the ratings on the capacity charts in the Crane Rating Manual.
2	25,840	31,200	
3	38,760	46,800	
4	51,680	62,400	Study Operator's Manual for wire rope inspection procedures.
5	64,600	78,000	
6	77,520	93,600	*Use of swivel end with 1 part of line is not recommended.
7	90,440	109,200	
8	103,360	124,800	
9	116,280	140,400	

Calculating Crane Capacities: Grove RT525

Utilize load chart on the next few pages to work through the first three exercises. Additional RT525 exercises can be found at the end of this module.

ROUGH TERRAIN HYDRAULIC CRANE

Exercise #1:

Configuration:

Outriggers extended
75' boom length
45' radius
2 part hoist line
25 ton block
Rigging 60 lbs.

Gross Capacity		7,310
25t Block	-	550
Rigging	-	60
Net Capacity		6,700

Determine:

Gross capacity: 7,310
Net capacity: 6,700
Approximate tip height: 66'

Exercise #2:

Configuration:

Outriggers extended
33,625 lb. load
25 ton block
Rigging 200 lbs.

Net		33,625
25t Block	+	550
Rigging	+	200
Gross Load		34,375

Determine:

Maximum radius: 12'
Longest boom length: 50'
Parts of line required with 18x19 rope: 4

Exercise #3:

Configuration:

Outriggers extended
1 ton lift on aux boom nose
30' from 30' tall building
7.5 ton ball
25 ton block
Rigging 20 lbs.

Net		2,000
Aux. BN	+	142
7.5 ton ball	+	354
25t Block	+	550
Rigging	+	20
Gross Load		3,066

Determine:

Distance beyond wall load can be set: 29'
Tip height above roof: 20'
Approximate boom angle: 30 °

Notes:

GROVE®

LOAD CHARTS
RT525E

85% STABILITY
ON OUTRIGGERS
75% STABILITY
ON RUBBER

NOTES FOR LIFTING CAPACITIES

GENERAL:

1. Rated loads as shown on lift chart pertain to this machine as originally manufactured and equipped. Modifications to the machine or use of optional equipment other than that specified can result in a reduction of capacity.
2. Construction equipment can be hazardous if improperly operated or maintained. Operation and maintenance of this machine shall be in compliance with the information in the Operator's and Safety Handbook, Service Manual and Parts Manual supplied with this machine. If these manuals are missing, order replacements from the manufacturer through the distributor.
3. The operator and other personnel associated with machine shall fully acquaint themselves with the latest American National Safety Standards (ASME/ANSI) for cranes.

SETUP:

1. The machine shall be level and on a firm supporting surface. Depending on the nature of the supporting surface, it may be necessary to have structural supports under the outrigger floats or tires to spread the load to a larger bearing surface.
2. For outrigger operation, all outriggers shall be properly extended with tires raised free of crane weight before operating the boom or lifting loads.
3. When machine is equipped with center front stabilizer, the front stabilizer shall be set in accordance with instructions in Operator's and Safety Handbook.
4. When equipped with removable and/or extendible counterweight, the proper counterweight shall be installed and fully extended before and during operation.
5. Tires shall be inflated to the recommended pressure before lifting on rubber.
6. With certain boom and hoist tackle combinations, maximum capacities may not be obtainable with standard cable lengths.
7. Unless approved by the crane manufacturer, do not travel with boom extension or jib erected unless otherwise noted. Refer to Operator's and Safety Handbook for job-site travel information.

OPERATION:

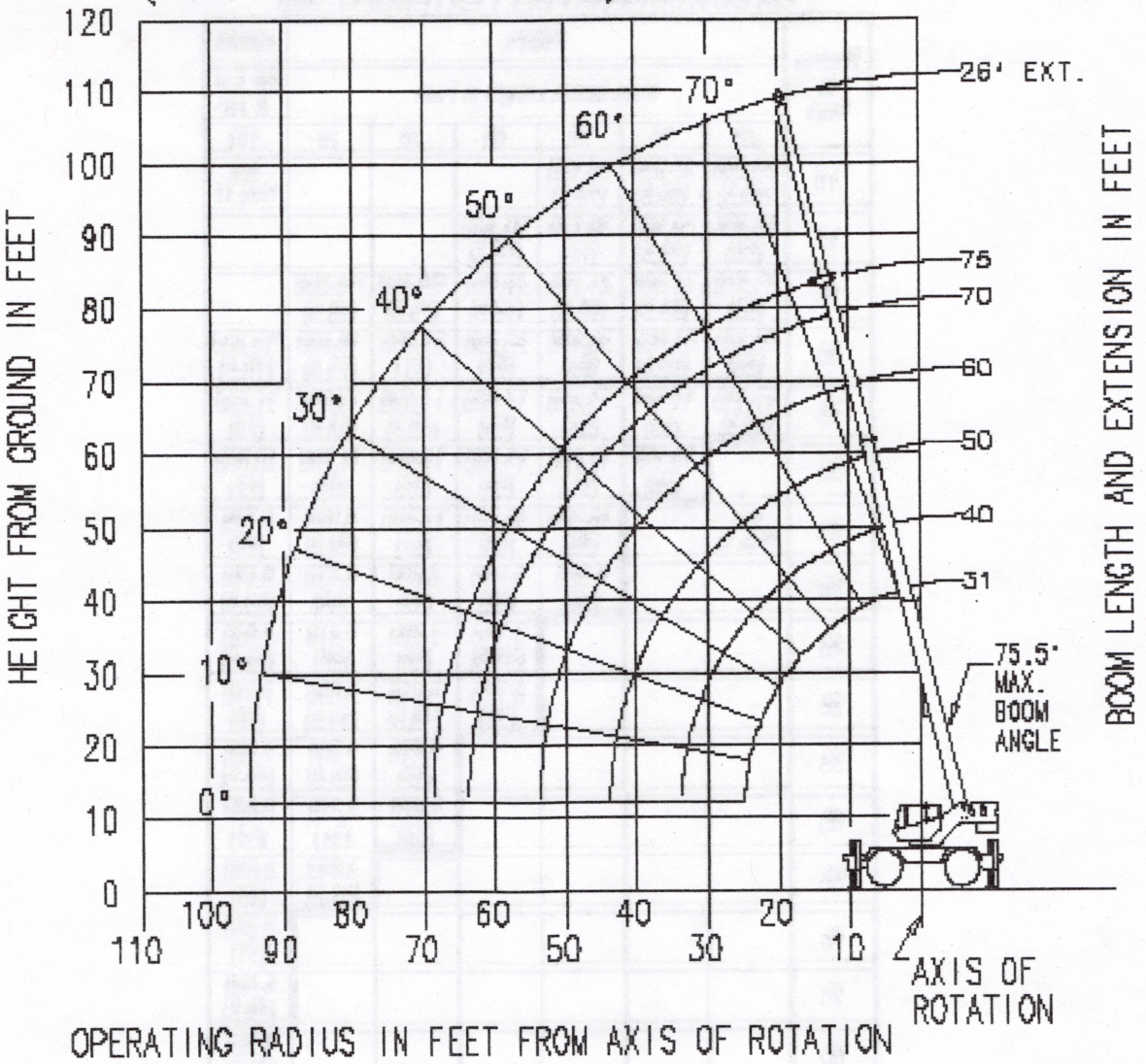
1. Rated loads at rated radius shall not be exceeded. Do not attempt to tip the machine to determine allowable loads. For clamshell or concrete bucket operation, weight of bucket and load must not exceed 80% of rated lifting capacities.
2. All rated loads have been tested to and meet the requirements of SAE J1063 - Cantilevered Boom Crane Structures - Method of Test, and do not exceed 85% of the tipping load on outriggers fully extended and SAE J1283 - Mobile Crane Stability Ratings [1.25P = (T-0.1A)] on outriggers 50% and 0% extended (fully retracted) as determined by SAE J765 - Crane Stability Test Code.
3. Rated loads include the weight of hookblock, slings and auxiliary lifting devices and their weights shall be subtracted from the listed rating to obtain the net load to be lifted. When more than the minimum required hoist reeving is used, the additional rope weight shall be considered part of the load to be lifted.
4. Load ratings are based on freely suspended loads. No attempt shall be made to move a load horizontally on the ground in any direction.
5. The maximum in-service wind speed is 20 m.p.h. It is recommended when wind velocity is above 20 m.p.h., rated loads and boom lengths shall be appropriately reduced. For machines not in-service, the main boom should be retracted and lowered with the swing brake set in wind velocities over 30 m.p.h.
6. Rated loads are for lift crane service only.
7. Do not operate at a radius or boom length where capacities are not listed. At these positions, the machine may overturn without any load on the hook.
8. The maximum load which can be telescoped is not definable because of variations in loadings and crane maintenance, but it is safe to attempt retraction and extension of the boom within the limits of the capacity chart.
9. When the boom length or lift radius or both are between values listed, the smallest load shown at either the next larger radius or next longer or shorter boom length shall be used.
10. For safe operation, the user shall make due allowances for his particular job conditions, such as: soft or uneven ground, out of level conditions, high winds, side loads, pendulum action, jerking or sudden stopping of loads, experience of personnel, two machine (tandem) lifts, traveling with loads, electric wires, obstacles, hazardous conditions, etc. Side pull on boom or jib is extremely dangerous.
11. If machine is equipped with individually controlled powered boom sections, the boom sections must be extended equally at all times.
12. Never handle personnel with this machine unless the requirements of the applicable national, state, and local regulations and safety codes are met.
13. Keep load handling devices a minimum of 42 inches (107 cm) below boom head at all times.
14. The boom angle before loading should be greater than the loaded boom angle to account for deflection.
15. Capacities appearing above the bold line are based on structural strength and tipping should not be relied upon as a capacity limitation.
16. Capacities for the 31 ft. boom length shall be lifted with boom fully retracted. If boom is not fully retracted, capacities shall not exceed those shown for the 40 ft. boom length.
17. For boom lengths less than 101 ft. with the 25 ft. boom extension erected, the rated loads are determined by boom angle in the column headed by 101 ft. For boom angles not shown, use rating of next lower boom angle. For this load column, the 25 ft. boom extension operational mode is to be selected on the LMI.
17. When operating the machine in the "On Outriggers 50% Extended (14' spread)" mode, the outrigger beam pins must be engaged. When operating in the "On Outriggers 0% Extended (7' 10" spread)" mode, the outrigger beams must be fully retracted. Failure to follow these precautions could result in structural damage or loss of stability of the machine.
18. All capacities on the main boom charts (for all outrigger spreads) reflect the deduct for a stowed boom extension. No other stowed boom extension deduct is required by the crane operator.
19. Do not lift loads when boom is fully lowered. The Load Moment Indicator (LMI) senses pressure and will not provide warnings or lockout. The crane can become overloaded if lift cylinder(s) is fully retracted.
20. The maximum outrigger pad load is 38,500 lb.

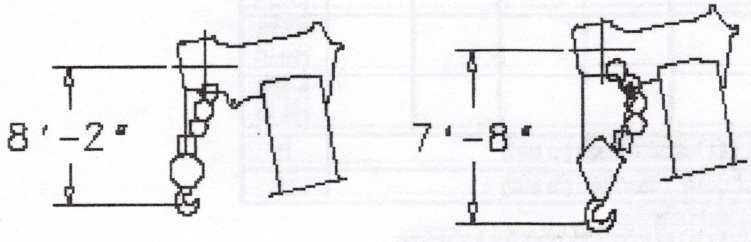
DEFINITIONS:

1. Operating Radius: Horizontal distance from a projection of the axis of rotation to the supporting surface before loading to the center of the vertical hoist line or tackle with load applied.
2. Loaded Boom Angle (Shown in Parenthesis on Main Boom Capacity Chart): is the angle between the boom base section and the horizontal, after lifting the rated load at the rated radius with the rated boom length.
3. Working Area: Areas measured in a circular arc about the center line of rotation as shown on the working area diagram.
4. Freely Suspended Load: Load hanging free with no direct external force applied except by the lift cable.
5. Side Load: Horizontal force applied to the lifted load either on the ground or in the air.

WORKING RANGE DIAGRAM

(BOOM DEFLECTION NOT SHOWN) D6-829-101823





DIMENSIONS ARE FOR LARGEST GROVE FURNISHED HOOK BLOCK AND HEADACHE BALL, WITH ANTI-TWO BLOCK ACTIVATED.

RATED LIFTING CAPACITIES IN POUNDS
31 FT. - 75 FT. BOOM
ON OUTRIGGERS FULLY EXTENDED - 360°

Radius in Feet	#8081						#8083
	Main Boom Length in Feet						26' Ext. & 75'
	31	40	50	60	70	75	101
10	50,000 (83.5)	42,850 (69.5)	39,150 (74.5)				See Note 17
12	39,300 (59)	38,400 (66.5)	36,100 (72)	*31,450 (75.5)			
15	31,300 (52)	31,300 (61.5)	31,700 (66.5)	27,850 (72.5)	*25,300 (75.5)	*18,200 (75.5)	
20	22,450 (38)	23,050 (52.5)	23,450 (62)	23,250 (67)	21,000 (71)	18,200 (72.5)	*12,850 (75.5)
25	17,150 (12.5)	17,300 (42)	17,450 (55)	17,900 (62)	17,500 (66.5)	13,300 (68.5)	11,550 (75)
30		13,450 (28)	13,700 (47)	14,000 (56)	13,800 (62)	11,200 (64)	10,850 (72)
35	See Note 16		10,500 (38)	10,750 (50)	10,900 (57)	9,800 (59.5)	9,720 (68)
40			8,500 (28)	8,840 (43)	9,000 (52)	8,330 (55)	8,840 (65.5)
45				7,140 (34.5)	7,290 (46)	7,310 (50)	7,820 (62.5)
50				5,740 (24)	5,910 (39.5)	6,050 (44.5)	7,440 (59)
55					4,840 (32)	4,990 (38.5)	7,280 (55.5)
60					3,970 (22)	4,140 (31)	6,660 (52)
65						3,440 (21.5)	5,880 (48)
70							5,340 (44)
75							4,880 (39.5)
80							4,350 (34.5)
85							3,830 (28.5)
90							3,390 (20.5)
Minimum boom angle (°) for indicated length (no load)							0
Maximum boom length (ft.) at 0° boom angle (no load)							75

NOTE: ( ) Boom angles are in degrees.
#LMI operating code. Refer to LMI manual for operating instructions.
*This capacity is based on maximum boom angle.

Lifting Capacities at Zero Degree Boom Angle On Outriggers Fully Extended - 360°							
Boom Angle	Main Boom Length in Feet						
	31	40	50	60	70	75	101
0 deg.	10,950 (25.3)	7,360 (33.8)	5,190 (43.8)	3,740 (53.8)	3,000 (63.8)	3,000 (69.8)	3,000 (84.8)

NOTE: ( ) Reference radii in feet. A5-029-1018138

ON RUBBER CAPACITIES

STATIONARY CAPACITIES 360°

Radius in Feet	#9005		
	Main Boom Length in Feet		
	31	40	50
10	23,150 (63.5)	21,750 (69.5)	*20,300 (74.5)
12	21,050 (59)	21,050 (66.5)	20,300 (72)
15	14,500 (52)	14,500 (61.5)	14,500 (68.5)
20	9,080 (38)	9,080 (52.5)	9,080 (62)
25	6,250 (12.5)	6,250 (42)	6,250 (55)
30		4,500 (29)	4,500 (47)
35			3,350 (38)
40			2,560 (26)
Min. boom angle for indicated length (no load)			0
Max. boom length at 0° boom angle (no load)			50

NOTE: ( ) Boom angles are in degrees.
#LMI operating code. Refer to LMI manual for instructions.

Lifting Capacity at Zero Degree			
Boom Angle	Main Boom Length in Feet		
	31	40	50
0°	6,130 (25.3)	3,580 (33.8)	2,100 (43.8)

NOTE: ( ) Reference radii in feet.

*This capacity is based upon max. boom angle.

A8-828-101842A

STATIONARY CAPACITIES DEFINED ARC OVER FRONT (See Note 3)

Radius in Feet	#9005		
	Main Boom Length in Feet		
	31	40	50
10	23,150 (63.5)	21,750 (69.5)	20,300 (74.5)
12	23,150 (59)	21,750 (66.5)	20,300 (72)
15	20,650 (52)	20,650 (61.5)	20,300 (68.5)
20	16,800 (38)	16,800 (52.5)	16,800 (62)
25	12,050 (12.5)	12,050 (42)	12,050 (55)
30		8,970 (29)	8,970 (47)
35			6,990 (38)
40			5,600 (26)
Min. boom angle for indicated length (no load)			0
Max. boom length at 0° boom angle (no load)			50

NOTE: ( ) Boom angles are in degrees.
#LMI operating code. Refer to LMI manual for instructions.

Lifting Capacity at Zero Degree			
Boom Angle	Main Boom Length in Feet		
	31	40	50
0°	10,950 (25.3)	7,360 (33.8)	4,780 (43.8)

NOTE: ( ) Reference radii in feet.

A8-828-101841

ON RUBBER CAPACITIES (cont'd.)

PICK & CARRY CAPACITIES (UP TO 2.5 MPH) - BOOM CENTERED OVER FRONT (See note 7)

Radius in Feet	#9006		
	Main Boom Length in Feet		
	31	40	50
10	24,800 (63.5)	24,800 (69.5)	20,450 (74.5)
12	24,800 (59)	24,800 (66.5)	20,450 (72)
15	20,450 (52)	20,450 (61.5)	20,450 (68.5)
20	15,050 (38)	15,050 (52.5)	15,050 (62)
25	12,050 (12.5)	12,050 (42)	12,050 (55)
30		8,970 (29)	8,970 (47)
35			6,990 (38)
40			5,270 (26)
Min. boom angle for indicated length (no load)			0
Max. boom length at 0° boom angle (no load)			50

NOTE: ( ) Boom angles are in degrees.
#LMI operating code. Refer to LMI manual for instructions.

Lifting Capacity at Zero Degree			
Boom Angle	Main Boom Length in Feet		
	31	40	50
0°	10,950 (25.3)	7,360 (33.8)	4,600 (43.8)

NOTE: ( ) Reference radii in feet.

A8-829-101843

NOTES TO ALL RUBBER CAPACITY CHARTS:

1. Capacities are in pounds and do not exceed 75% of tipping loads as determined by test in accordance with SAE J765.
2. Capacities are applicable to machines equipped with 20.5x25 (24 ply) tires at 75 psi cold inflation pressure.
3. Defined Arc - Over front includes 6" on either side of longitudinal centerline of machine (ref. drawing C6-829-003529).
4. Capacities appearing above the boldline are based on structural strength and tipping should not be relied upon as a capacity limitation.
5. Capacities are applicable only with machine on firm level surface.
6. On rubber lifting with boom extensions not permitted.
7. For pick and carry operation, boom must be centered over front of machine, mechanical swing lock engaged and load restrained from swinging. When handling loads in the structural range with capacities close to maximum ratings, travel should be reduced to creep speeds.
8. Axle lockouts must be functioning when lifting on rubber.
9. All lifting depends on proper tire inflation, capacity and condition. Capacities must be reduced for lower tire inflation pressures. See lifting capacity chart for tire used. Damaged tires are hazardous to safe operation of crane.
10. Creep - not over 200 ft. of movement in any 30 minute period and not exceeding 1 mph.

RATED LIFTING CAPACITIES IN POUNDS
31 FT. - 75 FT. BOOM
ON OUTRIGGERS 50% EXTENDED (14.0 FT. SPREAD) - 360°

Radius in Feet	#4801						#4803
	Main Boom Length in Feet						26' Ext. & 75'
	31	40	50	60	70	75	101
10	50,000 (83.5)	42,850 (69.5)	39,150 (74.5)				See Note 17
12	39,300 (59)	38,400 (66.5)	36,100 (72)	*31,450 (75.5)			
15	31,300 (52)	31,300 (61.5)	31,700 (68.5)	27,850 (72.5)	*25,300 (75.5)	*16,200 (75.5)	
20	22,450 (38)	23,050 (52.5)	23,450 (62)	23,250 (67)	21,000 (71)	16,200 (72.5)	*12,850 (75.5)
25	16,750 (12.5)	17,200 (42)	17,450 (55)	17,750 (62)	17,300 (66.5)	13,300 (66.5)	11,550 (75)
30		12,450 (29)	12,850 (47)	13,150 (56)	13,350 (62)	11,200 (64)	10,650 (72)
35	See Note 16		9,520 (35)	10,150 (50)	10,300 (57)	9,600 (59.5)	9,720 (69)
40			7,680 (26)	8,040 (43)	8,200 (52)	8,270 (55)	8,590 (65.5)
45				6,480 (34.5)	6,630 (46)	6,700 (50)	7,200 (62.5)
50				5,250 (24)	5,400 (39.5)	5,480 (44.5)	5,970 (59)
55					4,440 (32)	4,510 (38.5)	4,980 (55.5)
60					3,650 (22)	3,720 (31)	4,180 (52)
65						3,070 (21.5)	3,520 (48)
70							2,980 (44)
75							2,490 (38.5)
80							2,080 (34.5)
85							1,720 (28.5)
90							1,410 (20.5)
0.1A (lb.)	505	470	445	430	420	415	375
Minimum boom angle (°) for indicated length (no load)							0
Maximum boom length (ft.) at 0° boom angle (no load)							75

NOTE: ( ) Boom angles are in degrees.
#LMI operating code. Refer to LMI manual for operating instructions.
*This capacity is based on maximum boom angle.

Lifting Capacities at Zero Degree Boom Angle On Outriggers 50% Extended - 360°							
Boom Angle	Main Boom Length in Feet						
	31	40	50	60	70	75	101
0 deg.	10,950 (25.3)	7,360 (33.5)	5,190 (43.8)	3,740 (53.8)	2,710 (63.8)	2,080 (68.8)	1,140 (94.8)

NOTE: ( ) Reference radii in feet. A6-829-101814A

RATED LIFTING CAPACITIES IN POUNDS
31 FT. - 75 FT. BOOM

ON OUTRIGGERS 0% EXTENDED (7 FT. 10 IN. SPREAD) - 360°

Radius in Feet	#8001					
	Main Boom Length in Feet					
	31	40	50	60	70	75
10	33,700 (63.5)	32,050 (69.5)	30,150 (74.5)			
12	26,200 (59)	25,300 (66.5)	24,100 (72)	*23,000 (75.5)		
15	19,150 (52)	18,800 (61.5)	18,200 (68.5)	17,500 (72.5)	*16,850 (75.5)	*16,200 (75.5)
20	12,200 (38)	12,550 (52.5)	12,350 (62)	12,100 (67)	11,750 (71)	11,600 (72.5)
25	8,040 (12.5)	8,470 (42)	8,890 (55)	8,840 (62)	8,700 (66.5)	8,600 (68.5)
30		5,920 (29)	6,340 (47)	6,650 (56)	6,590 (62)	6,550 (64)
35	See Note 16		4,610 (38)	4,980 (50)	5,080 (57)	5,060 (59.5)
40			3,360 (26)	3,720 (43)	3,870 (52)	3,930 (55)
45				2,770 (34.5)	2,930 (46)	3,000 (50)
50				2,030 (24)	2,190 (39.5)	2,260 (44.5)
55					1,590 (32)	1,670 (38.5)
60					1,110 (22)	1,190 (31)
D.1A (lb.)	505	470	445	430	420	415
Minimum boom angle (°) for indicated length (no load)						0
Maximum boom length (ft.) at 0° boom angle (no load)						75

NOTE: ( ) Boom angles are in degrees.
#LMI operating code. Refer to LMI manual for operating instructions.
*This capacity is based on maximum boom angle.

Lifting Capacities at Zero Degree Boom Angle On Outriggers 0% Extended - 360°						
Boom Angle	Main Boom Length in Feet					
	31	40	50	60		
0 deg.	7,860 (25.3)	4,540 (33.8)	2,610 (43.8)	1,560 (53.8)		

NOTE: ( ) Reference radii in feet. A6-B28-101815A

TIRE INFLATION - PSI (BAR)				
SIZE (FRONT & REAR)	LOAD RANGE	TRA CODE	LIFTING SERVICE AND GENERAL TRAVEL	EXTENDED TRAVEL
			STATIC, CREEP & 2.5 MPH (4.0 km/h)	
20.5x25	24 PR	E-3	75 (5.2)	70 (4.8)

Additional Grove RT525 Exercises

Configuration:

Outriggers extended
65' boom length
35' radius
25 ton block
Rigging 60 lbs.

Gross Capacity	10,750
25t	550
Rigging -	60
Net Capacity	10,140

Determine:

Gross capacity: 10,750
Net capacity: 10,140
Parts of line required with 18x19 rope: 2

Configuration:

Outriggers extended
40' boom length
15' radius
5 part 6x37 hoist line
25 ton load block
Rigging 80 lbs.

Gross Capacity	31,300
25t Block	550
Rigging	80
2 parts x 45ft. x1 lb./ft. -	90
Net Capacity	30,580

Determine:

Net capacity: 30,670
Parts of line required: 3
Approximate boom angle: 61.5 °

Configuration:

Outriggers extended
75' boom length
60' radius
Stowed extension
7.5 ton ball
Rigging 40 lbs.

Gross Capacity	4,140
Stowed Extension	0
7.5t Ball	354
Rigging -	40
Net Capacity	3,746

Determine:

Effective weight of stowed extension: 0
Net capacity: 3,746
Boom angle: 31 °

Configuration:

Outriggers extended
Lifting from 70' main boom
43' radius
26' ext. erected
7.5 ton ball
25 ton load block
Rigging 20 lbs.

Gross Capacity	7,290
26' Ext	1,710
7.5t Ball	354
25t Block	550
Rigging -	20
Net Capacity	4,656

Determine:

Net capacity: 4,656
Approximate boom angle: 46 °

Configuration:

Outriggers extended
Picking from 26' ext. at a 55' radius
7.5 ton ball
25 ton block
Rigging 40 lbs.

Gross Capacity	7,260
7.5t Ball	354
25t Block	550
Rigging -	40
Net Capacity	6,316

Determine:

Net capacity: 6,316
Approximate boom angle: 55.5 °

Configuration:

360 ° on rubber
Aux. boom head erected
45' boom at a 29'radius
7.5 ton ball
Rigging 20 lbs.

Gross Capacity	4,500
Aux BN	142
7.5t Ball	354
Rigging -	20
Net Capacity	3,984

Determine:

Net capacity: 3,984
Approximate tip height: 40'

Configuration:

Outriggers extended
72' boom at a 37' radius
7.5 ton ball
25 ton block
Rigging 35 lbs.

Gross Capacity		8,330
7.5t Ball		354
25t Block		550
Rigging	-	35
Net Capacity		7,391

Determine:

Loaded tip height: 68'
Net load: 7,391

Configuration:

Outriggers extended
Lifting 2,627 lbs. from 26' ext. on 75' boom
7.5 ton ball
Rigging 15 lbs.

Net Load		2,627
7.5t Ball		354
Rigging	+	15
Gross Load		2,996

Determine:

Longest radius: 94.8'
Loaded tip height: 11'
Boom angle: 0 °

Configuration:

Pick and carry 19,240 lbs. & set off the side on rubber
40' boom
25 ton block
Rigging 85 lbs.

Net Load		19,240
25t Block		550
Rigging	+	85
Gross Load		19,875

Determine:

Gross load: 19,875
Longest radius off the front: 15'
Longest radius off the side: 12'

Configuration:

Outriggers extended
Lifting 42,790 lbs. from the main with 18x19
25 ton block
Rigging 400 lbs.

Net Load		42,790
25t Block		550
Rigging	+	400
Gross Load		43,740

Determine:

Longest radius: 10'
Longest boom allowed: 31'
Parts of line are required: 5

Calculating Crane Capacities: Link Belt HTC-8670LB

The load chart for this crane is more extensive and could not be included in the student manual. The step-by step examples below are meant to demonstrate a more complex set of calculations.

Exercise #4:

Configuration:

- Lifting over side in "mode A", Outriggers fully extended, 12,000lb counterweight
- 60' boom, 30 foot radius
- 70 ton block
- 8.5 ton ball (8' below tip)
- Type ZB rope
- 67' Fly erected
- 55 lbs. rigging

Determine:

- Gross capacity — 40,600
- Approximate boom angle — 54.5°
- Net capacity — 30,577
- Number of parts of line required — 3
- Approximate boom tip height — 57'

Step 1: Find gross capacity + approx. boom angle

Load Radius (Ft.)	60 Ft.			69.6 Ft.			Load Radius (Ft.)
	∠°	360°	Over Rear	∠°	360°	Over Rear	
10	76.5	74,000	74,000				10
12	74.5	74,000	74,000	76.5	43,900	43,900	12
15	71.5	74,000	74,000	74.5	43,900	43,900	15
20	66.0	72,000	72,000	70.0	43,900	43,900	20
25	60.5	55,200	55,200	65.5	43,900	43,900	25
30	54.5	40,600	40,600	61.0	37,900	37,900	30
35	48.5	30,800	30,800	55.5	30,400	30,400	35
40	41.0	24,200	24,200	50.5	23,800	23,800	40
45	32.5	19,300	19,300	44.5	19,000	19,000	45
50	21.0	15,500	15,500	37.5	15,300	15,300	50
55				29.5	12,500	12,500	55
60				18.5	10,100	10,100	60
Min.Boom Ang/Cap.	0 (53.0)	10,800	10,800	0 (62.6)	7,300	7,300	Min.Boom Ang/Cap.

Step 2: Determine net capacity

CAPACITY DEDUCTIONS FOR AUXILIARY LOAD HANDLING EQUIPMENT

Load Handling Equipment	Weight (Lbs.)
Auxiliary Head Attached	100
40 Ton Quick Reeve 4 Sheave Hook Block (See Hook Block For Actual Weight)	720
60 Ton Quick Reeve 4 Sheave Hook Block (See Hook Block For Actual Weight)	1100
70 Ton Quick Reeve 5 Sheave Hook Block (See Hook Block For Actual Weight)	1400
9.5 Ton Hook Ball (See Hook Ball For Actual Weight)	360
Lifting From Main Boom With:	
39.5 Ft. Or 67 Ft. Fly Stowed On Base (See Operation Note 4)	0
39.5 Ft. Offset Fly Erected But Not Used	4100
67 Ft. Offset Fly Erected But Not Used	6200
Lifting From 39.5 Ft. Offset Fly With:	
27.5 Ft. Fly Tip Erected But Not Used	PROHIBITED
27.5 Ft. Fly Tip Stowed On 39.5 Ft. Offset Fly	PROHIBITED
Note: Capacity deductions are for Link-Belt supplied equipment only.	

Step 3: Determine parts of line

Net capacity + rigging and block = 32,032

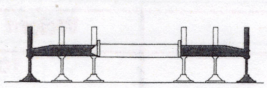
WIRE ROPE CAPACITY

Maximum Lifting Capacities Based On Wire Rope Strength			
Parts of Line	3/4" Type RB	3/4" Type ZB	Notes
1	12,920*	15,600	Capacities shown are in pounds and working loads must not exceed the ratings on the capacity charts in the Crane Rating Manual.
2	25,840	31,200	
3	38,760	46,800	Study Operator's Manual for wire rope inspection procedures.
4	51,680	62,400	
5	64,600	78,000	*Use of swivel end with 1 part of line is not recommended.
6	77,520	93,600	
7	90,440	109,200	
8	103,360	124,800	
9	116,280	140,400	
10	129,200	156,000	

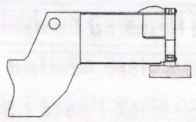
LBCE	DESCRIPTION
TYPE RB	18 X 19 Rotation Resistant - Compact Strand - High Strength Preformed, Right Regular Lay
TYPE ZB	36 X 7 Rotation Resistant - Extra Improved Plow Steel - Right Regular Lay

Step 4: Approximate boom tip height

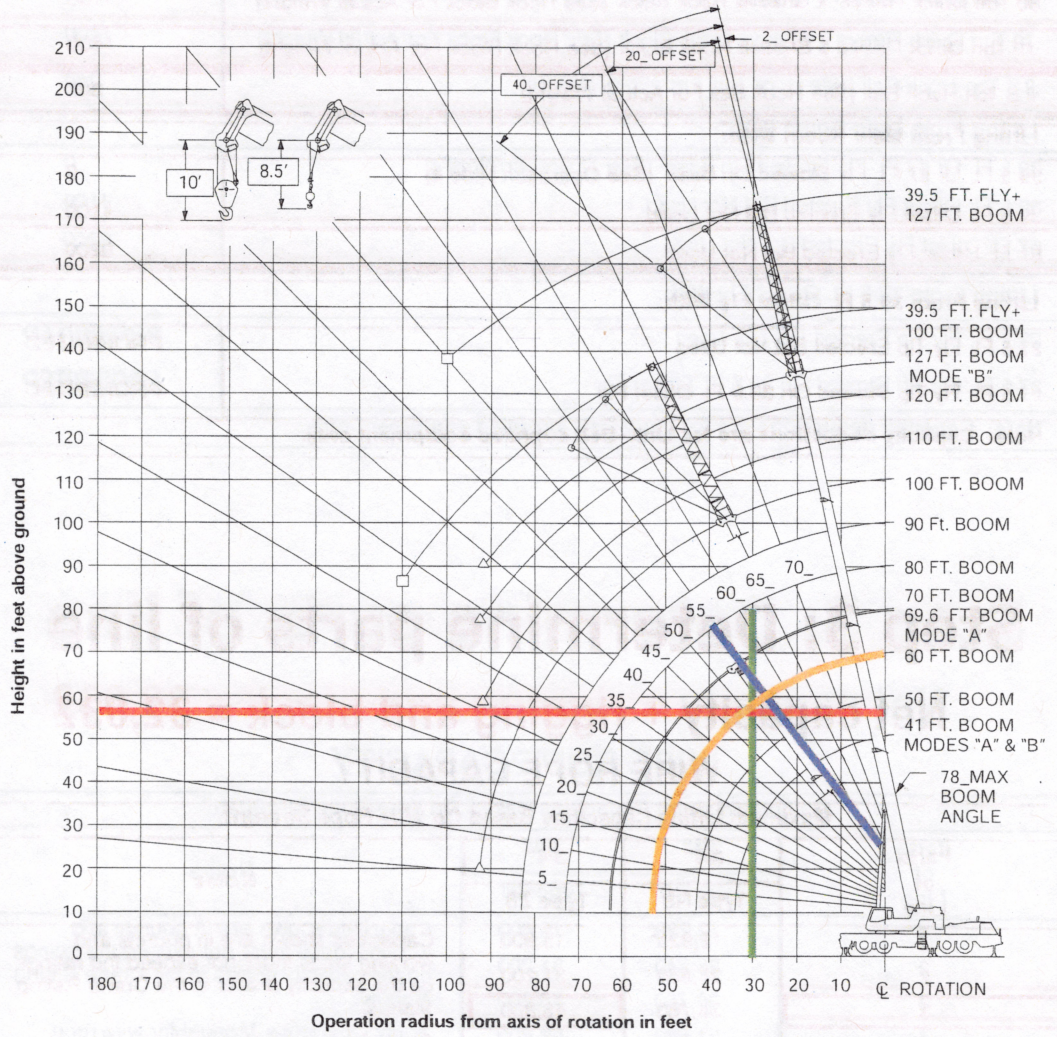
WORKING RANGE DIAGRAM



Fully Extended Outriggers



4,000# Counterweight



Crane Configurations Prohibited:
67 Ft. Offset Fly

j Denotes Main Boom + 39.5 'Fly--Boom Mode 'B"
△ Denotes Main Boom--Boom Mode 'B"

Note: Boom and fly geometry shown are for unloaded condition and crane standing level on firm supporting surface. Boom deflection, subsequent radius and boom angle change must be accounted for when applying load to hook.

WARNING

Do Not Lower The Boom Below The Minimum Boom Angle For No Load Stability As Shown In The Lift Charts For The Boom Lengths Given. Loss Of Stability Will Occur Causing A Tipping Condition.

Exercise #5:

Configuration:

- Lifting 9,380 lbs net over side
- Outriggers fully extended
- 8000lb counterweight
- 110 foot boom
- 40 ton block
- 67' Fly stowed
- 70 lbs. rigging
- Type RB rope with 4 parts

Determine:

• Maximum radius	60'
• Number of parts of line required	1
• Determine excess reeving deduction	291
• Gross load	10,461
• Approximate boom angle	55.5°

To find max radius, first add net load + capacity deductions

CAPACITY DEDUCTIONS FOR AUXILIARY LOAD HANDLING EQUIPMENT

Load Handling Equipment	Weight (Lbs.)
Auxiliary Head Attached	100
40 Ton Quick Reeve 4 Sheave Hook Block (See Hook Block For Actual Weight)	720
60 Ton Quick Reeve 4 Sheave Hook Block (See Hook Block For Actual Weight)	1100
70 Ton Quick Reeve 5 Sheave Hook Block (See Hook Block For Actual Weight)	1400
8.5 Ton Hook Ball (See Hook Ball For Actual Weight)	360
Lifting From Main Boom With:	
39.5 Ft. Or 67 Ft. Fly Stowed On Base (See Operation Note 4)	0
39.5 Ft. Offset Fly Erected But Not Used	4100
67 Ft. Offset Fly Erected But Not Used	8200
Lifting From 39.5 Ft. Offset Fly With:	
27.5 Ft. Fly Tip Erected But Not Used	PROHIBITED
27.5 Ft. Fly Tip Stowed On 39.5 Ft. Offset Fly	PROHIBITED

Net load + deductions

• Lifting 9,380 lbs net over side	+ 9,380
• Outriggers fully extended	
• 8000lb counterweight	
• 110 foot boom	+ 720
• 40 ton block	+ 0
• 67' Fly stowed	+ 70
• 70 lbs. rigging	
• Type RB rope with 4 parts	
Net load + capacity deductions	10,170

Step 1: Find maximum radius

Rated Lifting Capacities in Pounds
Fully Extended Outriggers
See Set Up Note 2

Load Radius (Ft.)	110 Ft. ∠	110 Ft. 360°	110 Ft. Over Rear	120 Ft. ∠	120 Ft. 360°	120 Ft. Over Rear	127 Ft. ∠	127 Ft. 360°	127 Ft. Over Rear	Load Radius (Ft.)
25	76.0	29,400	29,400	77.5	23,300	23,300	78.0°	19,600	19,600	25
30	73.5	26,200	26,200	75.0	23,300	23,300	76.0	19,600	19,600	30
35	70.5	23,500	23,500	72.5	21,500	21,500	74.0	19,600	19,600	35
40	68.0	21,200	21,200	70.0	19,400	19,400	71.5	18,400	18,400	40
45	65.0	19,200	19,200	67.5	17,600	17,600	69.0	16,400	16,400	45
50	62.0	17,000	17,000	65.0	15,800	15,800	66.5	14,900	14,900	50
55	58.5	14,200	14,200	62.0	14,200	14,300	64.0	13,600	13,600	55
60	56.5	11,900	12,100	59.0	12,000	12,200	61.5	12,100	12,300	60
65	52.0	10,100	10,300	56.0	10,100	10,400	58.5	10,200	10,400	65
70	48.0	8,500	8,800	53.0	8,500	8,900	56.0	8,600	8,900	70
75	44.5	7,200	7,500	49.5	7,200	7,600	53.0	7,300	7,600	75
80	40.5	6,000	6,400	46.5	6,100	6,500	49.5	6,200	6,500	80
85	35.5	5,100	5,400	42.5	5,100	5,500	46.5	5,200	5,600	85
90	30.5	4,200	4,600	38.5	4,300	4,700	43.0	4,300	4,700	90
95	24.5	3,500	3,800	34.5	3,600	3,900	39.5	3,600	4,000	95
100	16.0	2,800	3,100	29.5	2,900	3,200	35.5	2,900	3,300	100
Min Bm. Ang/ Cap.	10.5 (101.9)			25.0 (102.0)			32.5 (103.1)			Min Bm. Ang/ Cap.

Step 2: Determine parts of line

Net load + rigging and block 10,170

WIRE ROPE CAPACITY

Maximum Lifting Capacities Based On Wire Rope Strength

Parts of Line	3/4" Type RB	3/4" Type ZB	Notes
1	12,920*	15,600	Capacities shown are in pounds and working loads must not exceed the ratings on the capacity charts in the Crane Rating Manual.
2	25,840	31,200	
3	38,760	46,800	Study Operator's Manual for wire rope inspection procedures.
4	51,680	62,400	
5	64,600	78,000	*Use of swivel end with 1 part of line is not recommended.
6	77,520	93,600	
7	90,440	109,200	
8	103,360	124,800	
9	116,280	140,400	
10	129,200	156,000	

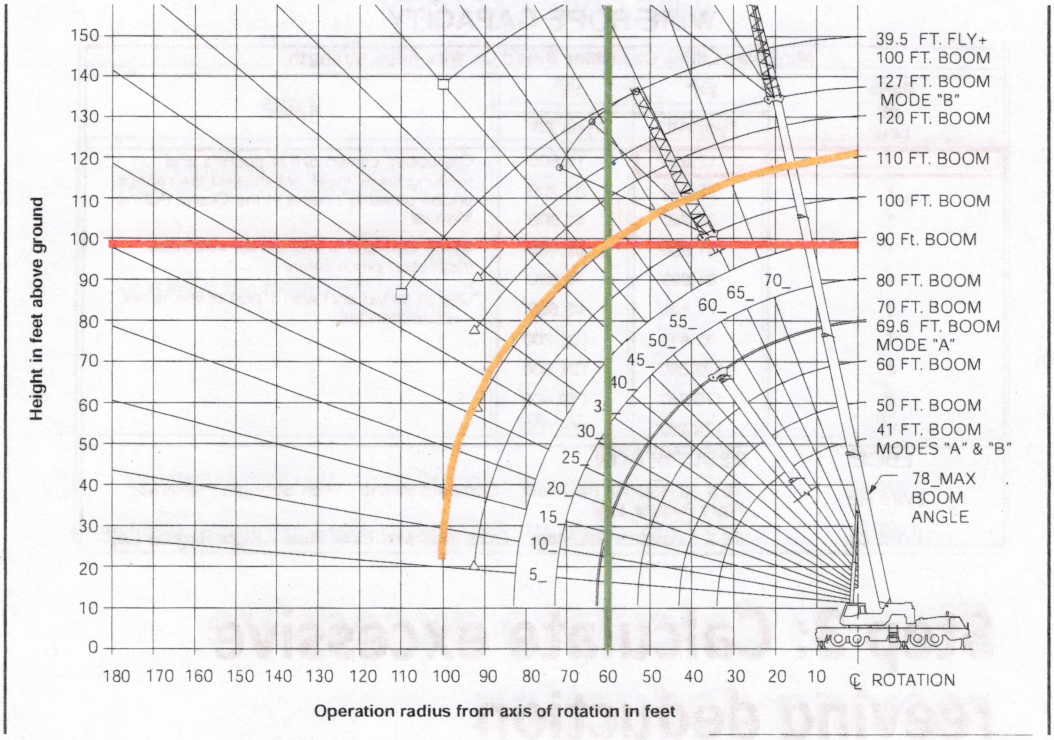
LBCE	DESCRIPTION
TYPE RB	18 X 19 Rotation Resistant - Compact Strand - High Strength Preformed, Right Regular Lay
TYPE ZB	36 X 7 Rotation Resistant - Extra Improved Plow Steel - Right Regular Lay

Step 3: Calculate excessive reeving deduction

While only 1 part of line is required, the crane is configured with 4 parts of line.

Calculate the weight of the extra 3 parts of line at a 60' radius.

Determine boom tip height to find length of excess reeving



Step 3: Calculate excessive reeving deduction

While only 1 part of line is required, the crane is configured with 4 parts of line.

Calculate the weight of the extra 3 parts of line at a 60' radius.

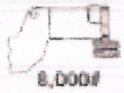
3	x	97'	x	1	=	291
Excess parts of line		Boom tip height at 60' radius		Weight of wire rope per foot		Total weight of excess reeving

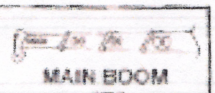
Step 4: Calculate gross load:

• Lifting 9,380 lbs. net over side	+ 9,380
• 40 ton block	+ 720
• 67' Fly stowed	+ 0
• 70 lbs. rigging	+ 70
• Type RB rope with 3 extra parts	+ 291
GROSS LOAD	10,461

Step 5: Approx. boom angle

Rated Lifting Capacities In Pounds
Fully Extended Outriggers
See Set Up Note 2.





Load Radius (Ft.)	110 Ft. ∠°	110 Ft. 360°	110 Ft. Over Rear	120 Ft. ∠°	120 Ft. 360°	120 Ft. Over Rear	127 Ft. ∠°	127 Ft. 360°	127 Ft. Over Rear	Load Radius (Ft.)
25	76.0	29,400	29,400	77.5	23,300	23,300	78.0*	19,600	19,600	25
30	73.5	26,200	26,200	75.0	23,300	23,300	76.0	19,600	19,600	30
35	70.5	23,500	23,500	72.5	21,500	21,500	74.0	19,600	19,600	35
40	68.0	21,200	21,200	70.0	19,400	19,400	71.5	18,400	18,400	40
45	65.0	19,200	19,200	67.5	17,600	17,600	69.0	16,400	16,400	45
50	62.0	17,000	17,000	65.0	15,800	15,800	66.5	14,900	14,900	50
55	58.5	14,200	14,200	62.0	14,200	14,300	64.0	13,600	13,600	55
60	55.5	11,900	12,100	59.0	12,000	12,200	61.5	12,100	12,300	60
65	52.0	10,100	10,300	56.0	10,100	10,400	58.5	10,200	10,400	65
70	48.0	8,500	8,800	53.0	8,600	8,900	56.0	8,600	8,900	70
75	44.5	7,200	7,500	49.5	7,200	7,600	53.0	7,300	7,600	75
80	40.5	6,000	6,400	46.5	6,100	6,500	49.5	6,200	6,500	80
85	35.5	5,100	5,400	42.5	5,100	5,500	46.5	5,200	5,600	85
90	30.5	4,200	4,600	38.5	4,300	4,700	43.0	4,300	4,700	90
95	24.5	3,500	3,800	34.5	3,600	3,900	39.5	3,600	4,000	95
100	16.0	2,800	3,100	29.5	2,900	3,200	35.5	2,900	3,300	100
Min.Bm. Ang/ Cap	10.5 (101.9)			26.0 (102.8)			32.5 (103.1)			Min.Bm. Ang/ Cap.

Notes: